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## Statewide Utility Codes and Standards Program Interim Verification Report

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## Introduction

An interim analysis was conducted to assess the 2006 and 2007 impacts of the utility Statewide Codes and Standards Program (C&S Program).<sup>1</sup> Because of the nature of the evaluation protocol for C&S Programs, this analysis differed from other program verifications in several major ways.

The interim analysis approach we used reflects the method utilities used to report their C&S Program claimed savings. They relied on the Savings Estimate Spreadsheet (SES) prepared by Heschong Mahone Group, Inc. (HMG). The SES is very consistent with the *California Energy Efficiency Protocols* approach for evaluating impacts of the C&S Program. Basically, the SES spreadsheet includes the following elements:

1. Statewide gross savings, by year, for each standard, based on unit energy savings and total units/buildings affected.
2. Adjustment for naturally occurring market adoption (NOMAD).
3. Compliance rate adjustment.
4. Adjustment for normally occurring standards adoption (NOSAD).
5. Attribution of overall standards savings to C&S Program.
6. Allocation of statewide savings to individual utilities.

The C&S Program evaluation is ongoing and focuses on assessing and revising, as appropriate, the values of each of these elements in the SES. For this interim study, our analysis primarily addresses Element 1 because this is consistent with the verification approach used in other programs, i.e., to true-up the number of units claimed. It is also likely to have a large effect on the claimed savings, and no evaluation results are yet available from work on the other elements.

Current status in evaluating the remaining elements is the following:

- *Adjustment for naturally occurring market adoption (NOMAD)*: The method developed by Quantec to estimate NOMAD trends for appliance and building standards has been modified. We have implemented the first stage of data collection for Title 20 appliance standards. No results are available yet.
- *Compliance rate adjustment*: Residential building standards compliance data are being collected through the baseline building characteristics field data collection effort in support of the Residential New Construction evaluation. This work has started, but no results are available yet. The plan for collecting non-residential building compliance data

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<sup>1</sup> This report was prepared by The Cadmus Group (Cadmus) under a subcontract with RLW Analytics, Inc. RLW Analytics, Inc. is under a prime contract with the California Public Utilities Commission. In May 2008, Cadmus merged with Quantec, LLC, which was the original subcontractor for this study.

is being developed with data collection expected to start in about one month. Planning for the appliance compliance data collection will also begin in about one month.

- *Adjustment for normally occurring standards adoption (NOSAD)*: No work has been started on this task. Discussions are underway about whether this element should be eliminated from the evaluation process.
- *Attribution of overall standards savings to C&S Program*: The details of the revised methodology have been developed and are undergoing internal review. Data collection is anticipated to begin in about one month.
- *Allocation of statewide savings to individual utilities*: No work has been conducted on this element.

**Overall, the findings from this interim study should be considered preliminary as they are based on limited analyses focused on factors affecting the gross savings. As noted above, analysis of the other elements affecting net impacts will continue and the results will be reflected in the final evaluation report.**

## Approach

### Claimed Savings

The first step was to determine savings claimed by each utility and the method used. We submitted an information request to all utilities and each responded that they had used the SES and discounted the SES estimates by 50%, pursuant to CPUC Decision D0509043.<sup>2</sup> When we compared the claimed savings against our version of the SES, however, we found three of the four utilities claimed different savings than those produced by the spreadsheet we were using. Through a series of discussions, we determined SCE was using the latest version of the SES (Version 3b) (the one being reviewed in the C&S Program evaluation), but the other utilities were using an earlier version (Version 3) (the officially posted one). For purposes of this interim study, the analysis uses each utility's claimed savings as produced by the SES version used.<sup>3</sup>

### Title 24 Building Standards

Fourteen Title 24 standards are included in the SES. Two are for Time Dependent Valuation (TDV) effects and are reported as separate standards: one for residential and one for non-residential buildings. Another standard is referred to as the "Composite for Remainder" (CfR) and captures all Title 24 changes for which the C&S Program did not produce a Codes and Standards Enhancement (CASE) report. Utilities have claimed some C&S Program savings from these Composite for Remainder standards due to utility participation in the standard-setting process.

For this initial assessment of claimed savings for every Title 24 standard, we reviewed each input that went into calculating its annual gross savings estimate. For standards affecting new construction, the SES savings estimates were based on projected annual building completions. We investigated two key relevant factors:

- 1) the lag time between permit application and construction completion
- 2) changes in the rate of construction

The first was important because meeting the 2005 Title 24 was a requirement for all buildings permitted after October 1, 2005, but many buildings constructed in 2006 and 2007 were likely to have been permitted prior to that date and, thus, not covered by the 2005 standards. The second was important because of recent construction market declines. Both impact the number of buildings for which the standards would generate energy savings.

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<sup>2</sup> CPUC. September 11, 2007. *D0509043 Interim Opinion: Energy Efficiency Portfolio Plans and Program Funding Levels for 2006-2008 - Phase 1 Issues*.

<sup>3</sup> We note that one notable change in Version 3b was the correction of start dates for several Title 24 standards. In Version 3, five standards effective in October 2005 are treated as if they went into effect in later years, so no savings are attributed to them in 2006. We discuss later how our analysis addresses these standards.

We developed an average lag time for single- and multifamily housing and non-residential buildings by contacting building officials at five departments around California.<sup>4</sup> Based on their best estimates, we derived the following average lag times:

- Single-family homes = 6 months
- Multifamily homes = 8 months
- Non-residential buildings = 9 months

Permit data were available through two sources. One was the Construction Industry Research Board (CIRB), which provides the number of residential units and dollar value of non-residential buildings permitted monthly. With the time lags, these data were adequate to estimate the number of the single- and multifamily units permitted and constructed during 2006 and 2007. For non-residential buildings, SES estimates are based on building floor area; consequently, we had to use a second database (from Reed Construction Data) to derive the average \$/square foot value of non-residential construction to convert the permit data to square footage.<sup>5</sup> For the verification savings estimate, the claimed savings were multiplied by either

- 1) the ratio of our current estimate of new floor area to the original projection or
- 2) the ratio of our estimate of constructed housing units to the original estimate.

The first approach was applied to non-residential buildings and the second was used for new single-family homes and multifamily units.

Version 3 of the SES failed to include energy savings in 2006 for five Title 24 standards that went into effect in 2006. For some of these standards the SES did not include savings for a few subsequent years as well. Version 3b, on the other hand, included savings for these standards implemented from 2006 onwards. To adjust for this problem in Version 3, we shifted the stream of savings in Version 3 forward for the affected standards shown in Table 1. The additional savings are accounted for in subsequent summary tables.

**Table 1. Implementation Date Adjustments for Standards in SES Version 3**

Building Standards (from Version 3 of the SES)	Shifted Periods
Time dependent valuation, non-residential	1 year
Residential hardwired lighting	2 years
Lighting controls under skylights	1 year
Ducts in existing commercial buildings	4 years
Relocatable classrooms	2 years

<sup>4</sup> The departments included Santa Rosa, San Mateo, Livermore, Fairfield, and Daly City.

<sup>5</sup> The Reed data are based on a sample of new construction so they do not capture all new construction.

For the TDV categories, claimed savings were adjusted in the same way, depending on whether the TDV value was for residential or non-residential buildings. The CfR claimed savings were adjusted in the same way by:

1. Multiplying the residential and non-residential components of the total gross savings for this category by our new construction adjustment factors.
2. Calculating the ratio of the resulting product to the original value.
3. Multiplying this ratio times the claimed savings.<sup>6</sup>

Some Title 24 standards affected only existing buildings (e.g., those that re-roofed). In these cases, no adjustment was made to the claimed savings, assuming the number of buildings affected did not depend on the construction rate. We also assumed the number of new relocatable classrooms was not affected by changes in the general construction market.

We did not modify any Title 24 unit energy savings, but we will continue researching the analyses and assumptions upon which the unit energy savings are based. When additional information is acquired and we have conducted further analyses, some of these may be modified, along with possible changes in other factors, for the final evaluation report.

## Title 20 Appliance Standards

The interim analysis approach for Title 20 standards was similar to that for Title 24 standards, but the focus was different. Appliance sales data are not as readily available for appliances as building permit data and, though we believe some sales projections need to be adjusted, it was not possible to do so for this interim analysis. In addition, we identified several appliances for which we believe adjustments to the unit savings reflected in the SES would be appropriate; however, for this report we did not yet have sufficient information to make these adjustments.

The one adjustment made for the Title 20 estimates was a correction for the standard's effective date. Both SES versions showed the Tier I External Power Supply standard going into effect in January 2006. Though this was the original effective date, the date was later moved to July 2007. We took this adjustment into account in this interim analysis.

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<sup>6</sup> ADM Associates. 2004. *Evaluation of 2002 Statewide Codes and Standards Program*.

## Findings

### Summary

The assessment described above was conducted for each of the standards. Table 2 summarizes the factors adjusted for this interim analysis of each standard. Savings for Title 24 standards were adjusted to account for actual construction rates during 2006 and 2007. We also note that SES Version 3 did not include savings from some of the Title 24 standards effective in 2006 and 2007 (such as Residential Hardwired Lighting and Lighting Controls under Skylights), although the standards went into effect in October 2005. To correct for the effect of this error in Version 3, we made adjustments to take these savings into account. On the other hand, savings for the Power Supplies, Tier I standard were adjusted to equal zero up until the actual effective date of July 2007, instead of counting savings from the original assumed effective date of January 2006 as both versions of the SES do.

**Table 2. Overview of Adjustments to Claimed Savings**

<b>Title 20 Appliance Standards</b>	
<b>Standard</b>	<b>Factors Adjusted</b>
External power supplies	Implementation date
Remaining Title 20 Standards	No adjustments
<b>Title 24 Building Standards</b>	
<b>Standard</b>	<b>Factors Adjusted</b>
Time dependent valuation, residential	Construction rate and permit-construction lag
Time dependent valuation, non-residential	Construction rate and permit-construction lag; implementation date (SDG&E, PG&E)
Residential hardwired lighting, single family	Construction rate, permit-construction lag, and single family allocation; implementation date (SDG&E, PG&E)
Residential hardwired lighting, multifamily	Construction rate, permit-construction lag, and multi family allocation; implementation date (SDG&E, PG&E)
Duct improvement	No adjustment
Window replacement	No adjustment
Lighting controls under skylights	Construction rate and permit-construction lag; implementation date (SDG&E, PG&E)
Ducts in existing commercial buildings	Implementation date (SDG&E, PG&E, SCG)
Cool roofs	No adjustment
Relocatable classrooms	Implementation date (SDG&E, PG&E)
Bi-level lighting control credits	No adjustment
Duct testing/sealing in new commercial buildings	Construction rate and permit-construction lag
Cooling tower applications	Construction rate and permit-construction lag
Multifamily water heating	Construction rate and permit-construction lag
Composite for Remainder GWh	Construction rate, permit-construction lag, and Composite for Remainder adjustment for building type
Composite for Remainder MW	Construction rate, permit-construction lag, and Composite for Remainder adjustment for building type
Composite for Remainder Mtherm	Construction rate, permit-construction lag, and Composite for Remainder adjustment for building type
Note: Permit-construction lag applied was 6 months for single-family residential, 8 months for multi family residential, and 9 months for non-residential buildings	

The 2006 and 2007 interim adjusted electricity savings for each utility are compared to their claimed savings in Table 3. In 2006, adjusted electricity savings for PG&E and SDG&E are about 88% of claimed savings and they are 74% for SCE. Since only one adjustment (the effective date of the standard) was made for appliance standards, the difference between claimed and adjusted Title 20 savings is relatively small. The difference for Title 24 is considerably larger, due primarily to the lag between building permitting and construction. As noted earlier, we adjusted SES Version 3 estimated savings for PG&E and SDG&E (and SCG) to correctly count savings starting in 2006 for all Title 24 standards effective as of October 2005. The notable difference between the SCE adjusted electricity savings as a percent of claimed savings and the values for the other utilities is due to the changes made in SES Version 3b. The changes were primarily reductions in the compliance rates based on empirical data incorporated in Version 3b, which SCE used .

The difference between claimed and adjusted Title 24 electricity savings declines in 2007. For 2007, Title 24 adjusted electricity savings are over 80% of the claimed savings for all utilities. The increase in the ratio of adjusted-to-claimed savings is because the lag between permitting and construction is not a factor in 2007 since, based on our assumed lags, all buildings constructed in 2007 were permitted after October 1, 2005, and subject to the new Title 24.

**Table 3. Interim Adjusted and Claimed Electricity Savings, GWh**

Year	Utility	Title 20		Title 24		Total		
		Claimed	Adjusted	Claimed	Adjusted	Claimed	Adjusted	% of Claimed
2006	PG&E	23.7	21.4	14.2	12.0	37.9	33.4	88%
	SDG&E	5.6	5.0	3.3	2.8	8.9	7.8	88%
	SCE	24.5	22.2	19.8	10.6	44.3	32.8	74%
	SCG	NA	NA	NA	NA	NA	NA	NA
2007	PG&E	23.7	22.8	15.4	12.9	39.1	35.8	91%
	SDG&E	5.6	5.3	3.6	3.0	9.2	8.4	91%
	SCE	25.7	24.7	18.4	11.8	44.1	36.5	82%
	SCG	NA	NA	NA	NA	NA	NA	NA

Note: Based on the data used in these analyses, the values reported should be considered to reflect two significant figures. Results have been rounded.

The results for demand are similar, as shown in Table 4. Adjusted savings as a percent of claimed saving differs from the values for electricity savings because not all measures affect both electricity usage and demand to the same degree. The difference between results for SCE and the other utilities is explained above.

**Table 4. Interim Adjusted and Claimed Demand Savings, MW**

Year	Utility	Title 20		Title 24		Total		
		Claimed	Adjusted	Claimed	Adjusted	Claimed	Adjusted	% of Claimed
2006	PG&E	3.5	3.3	7.5	6.4	11.0	9.7	88%
	SDG&E	0.8	0.8	1.8	1.5	2.6	2.3	88%
	SCE	3.8	3.5	8.6	5.4	12.4	9.0	72%
	SCG	NA	NA	NA	NA	NA	NA	NA
2007	PG&E	3.7	3.6	8.2	6.5	11.9	10.1	85%
	SDG&E	0.9	0.8	1.9	1.5	2.8	2.4	85%
	SCE	4.2	4.1	8.0	5.6	12.2	9.7	80%
	SCG	NA	NA	NA	NA	NA	NA	NA

Note: Based on the data used in these analyses, the values reported should be considered to reflect two significant figures. Results have been rounded.

The results for natural gas savings are shown in Table 5. The interim adjusted values are a higher percentage of claimed savings than electricity savings are. There are three main reasons for this different outcome. For Title 20, the interim adjusted natural gas savings match the claimed savings since we made no adjustments to appliance standards that produce gas savings. For Title 24, the most gas savings come from measures not directly affected by building starts, thus they

are not adjusted downward for permit-construction lags or reduced construction rates. Finally, shifting several Title 24 standards in the SES Version 3 to their proper effective date (October 2005) added savings that were not included in the values claimed by the utilities.

**Table 5. Interim Adjusted and Claimed Natural Gas Savings, Mtherms**

Year	Utility	Title 20		Title 24		Total		
		Claimed	Adjusted	Claimed	Adjusted	Claimed	Adjusted	% of Claimed
2006	PG&E	0.6	0.6	0.4	0.4	0.9	1.0	96%
	SDG&E	0.1	0.1	0.0	0.0	0.1	0.1	96%
	SCE	NA	NA	NA	NA	NA	NA	NA
	SCG	0.9	0.9	0.6	0.7	1.5	1.6	105%
2007	PG&E	0.5	0.5	0.3	0.4	0.8	0.9	109%
	SDG&E	0.1	0.1	0.0	0.0	0.1	0.1	109%
	SCE	NA	NA	NA	NA	NA	NA	NA
	SCG	0.8	0.8	0.5	0.7	1.3	1.5	109%

Note: Mtherms = million therms. Based on the data used in these analyses, the values reported should be considered to reflect two significant figures. Results have been rounded.

## Observations

These results are interim findings based on preliminary analyses and information. All factors affecting the adjusted savings from the C&S Program are being investigated as part of the overall program evaluation that will be completed in 2010. The findings here reflect the best estimate of adjusted 2006 and 2007 savings, taking into account the major variables that can be estimated at this time.

During the Title 20 savings assessment, we identified a few standards for which significant (>10%) reductions in estimated savings are likely in the final evaluation. Two are large enough that their reductions could significantly affect the total appliance standards savings claim. One standard is for General Service Incandescent Lamps. The adopted standard was less stringent than the requirements analyzed in the CASE report, so it is likely the actual savings impacts are less than those projected and included in the SES used by utilities to calculate claimed savings. The second appliance standard for which the evaluation is likely to produce significantly smaller *ex post* savings is the one for pre-rinse spray valves. A large program to replace pre-rinse spray valves was conducted just before this standard went into effect, so savings from the standard itself may have been significantly reduced.

During the Title 24 analysis for this interim report, we noted that differences between the compliance rates in the SES versions used by the utilities significantly affected the claimed savings. Our assessment did not attempt to adjust for these values; the adjustment for compliance rates will occur in the final evaluation report. We also identified some measures that will require more detailed investigation of their estimated unit energy savings. Questions have been posted to the authors of the relevant CASE reports and other documents, and, once those questions are resolved, it should be possible to determine what adjustments are appropriate when the final evaluation is conducted. Savings from the CfR composite standard also will be investigated in more detail for the final evaluation report.